[1904]

THE COMSTOCK LODE

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The announcement is made that the South End Comstock mines have associated themselves together and have entered into an agreement with the Alta Mining Company to use the shaft of that company to prospect and drain the lower levels of the Crown Point, Belcher, Yellow Jacket, Overman, California and Segregated Belcher; in fact, all the mines south of Alpha. This is another important step in the rehabilitation of the Comstock Lode and its restoration to the place it formerly occupied as the greatest mining camp in the world, and it will be demonstrated that this lode is the greatest mineralized zone that has ever been discovered.

The managers of the South End Comstock mines are amongst the most conservative mining men in the business. They have held back and waited the outcome of the work done in the Con. California and Virginia and other North End mines before undertaking the present work in the mines under their control. They have seen the success of the Evans hydraulic lift in the Consolidated California and Virginia shaft, and have also seen the successful working of the Reidler pumps driven by electric power from the Truckee River. They have seen as a result of the partial unwatering of the lower levels of these North End mines the opening of pay ore in the Con. California and Virginia and the Ophir mines, which have added fully two million dollars to the wealth of the world. They know that on the lower levels of the Crown Point and Belcher now under water there is good ore, and they know that the prospects in the Caledonia from the 900 level to the 1200 level warrants them in believing that continued improvement will be the conditions on the lower levels of that mine. They know that the chances of finding pay ore in the lower levels of their other mines are not unfavorable, and with the successful demonstration in the North End they, as cautious business men, believe that the time is ripe for an effort on their part to drain the lower levels of the Gold Hill group.

The importance of the move to unwater the South End Com-

stock mines is but little appreciated by the majority of people. This means a unity of action of all the mines on the lode. We now have a magnificent modern pumping plant in the Consolidated California and Virginia shaft. This pumping plant has shown its capacity by reducing the water in the Con. California and Virginia shaft from the 1750 level to below the 2350 level, thus draining all the North End mines. Beyond this, the measurements taken at the combination shaft show that the water has been materially reduced in the middle mines, and measurements taken at the Yellow Jacket shaft show that the water has been materially reduced as far south as the Yellow Jacket mine.

The Ward shaft has been opened and repaired 1678 feet to the water level. The specifications for a modern pumping plant for this shaft has almost been completed, and later on it will be installed. The pump designed for this shaft is improved so that it will be more powerful proportionately than the present Reidler pumps now working in the Cons. California and Virginia shaft.

The capacity of the pumps in the Cons. California and Virginia shaft is 4500 gallons per minute. The capacity of the pumps to be placed in the Ward shaft is to be 3000 gallons per minute. The capacity of these two pumps would be 10,800,000 gallons a day, working at full capacity.

In a report made by that eminent mining engineer, W. R. Eckart, published May 13, 1898, the statement is made that the Gold Hill group would require about 3000 gallons per minute pumping capacity. When the pumps of the Comstock Lode were stopped and the water permitted to overflow the lower levels it was estimated that they were lifting 5040 gallons per minute, or 7,257,600 gallons per day. As can be seen, the pumping plants now in the Consolidated California and Virginia, and to be placed in the Ward shaft, will have a capacity of 10,800,000 gallons per day, or 3,542,400 gallons more than the total amount of water made by the whole lode while the old system was in operation. The various pumping plants that lifted this 7,257,600 gallons of water cost fully $1,500,000. The cost of operating them was $34.13 per indicated horsepower per month. The total indicated horsepower was 1703. The cost per year was $697,440. This did not include the cost of repairs. At the time that these figures were made the hydraulic pumps were handling 2128 gallons per minute, and the Cornish pumps were pumping 2912 gallons per minute. To pump this 2912 gallons by the Cornish pumps there were 2 7-10 miles of pump rod, which with its connected bobs, pumps and moving machinery, weighed 6,496,400 pounds, or 2230 pounds for every gallon (weighing 8 1-3 pounds) of water pumped. This weight had to be started and brought to rest on an average of nine times per minute, and a train of cars over nine-tenths of a mile long would have been required to transport it.

Let us compare these figures with the modern pumping plant now installed in the Consolidated California and Virginia mines, and the one to be installed in the Ward shaft.

The Consolidated California and Virginia plant, with a capacity of 4500 gallons per minute, cost about..... $125,000

The Ward shaft plant, with a capacity of 3000 gallons per minute, will cost about..... $100,000

$225,000

This includes the cost of cutting out stations, foundation work and other details necessary to the completion of the two plants. The expense of operating the Consolidated California and Virginia pumping plant per month is about. $5,500

The expense of operating the Ward shaft pumping plant will be about $6,000

$11,500

The Consolidated California and Virginia pump is lifting from the 2400 level, while the Ward shaft pump will lift from the 2800 level. The cost per year of operating these two plants will be $138,000, with a capacity of 10,800,000 gallons per day, against the annual cost under the old system of $697,440 per annum, with a capacity of 7,257,600 gallons per day. Here we find a reduction in the cost of the plants amounting to 85 per cent, a reduction of the annual cost of operating amounting to 80 22-100 per cent and an increase in the annual capacity of 48 80-100 per cent.

The conditions can be understood by the following table:

	Estimated Cost.	Annual Capacity Gallons.	Annual Cost of Operation.
Old Comstock Pumping Plants.	$1,500,000	$7,257,600	$697,440
New Comstock Pumping Plants.	225,000	10,800,000	138,440

If it should be found necessary in the future to increase the pumping capacity on the Comstock Lode this could be easily done by installing a pumping plant in the Alta shaft, which has a depth of 2200 feet. The collar of the Alta shaft being about 427 feet lower than the collar of the Belcher shaft, this would mean a depth of 2627 feet in that shaft. The south lateral of the Sutro tunnel is connected with the Alta shaft, and the water could be lifted to the tunnel level and drained through the main tunnel. With a pumping plant at the Alta shaft with a capacity of 3500 gallons per minute, the Ward shaft plant of 3000 gallons per minute and the Consolidated California and Virginia plant with a capacity of 4500 gallons per minute, there would be a total capacity of 11,000 gallons per minute, which would equal 15,840,000 gallons per day. That this amount of water is not diffi-

cult to handle is shown by the fact that two underground pumps in use at the Mansfield mine in Germany have a capacity of 15,840,000 gallons per 24 hours, or 1,324,800 gallons more than twice the capacity of the combined Cornish and hydraulic pumps that ever pumped into the Sutro tunnel. In a letter to Engineer Eckart, dated Berlin, January, 1892, Mr. Reidler in mentioning a number of pump engines wrote as follows:

"The engine at Mayron shaft raises 500 gallons per minute in one lift 1720 feet high. This engine has been regularly at work for four years, that is to say, day and night, with a mean speed of 58 revolutions per minute (maximum 75 revolutions) without being stopped but for a few hours each week, and not yet having required any repairs. The introduction of high speed and high pressure pumps into deep mines is, therefore, no risk whatever. Mining people in Westphalia and on the Rhine are the very last to introduce new machinery. They are not progressive, so to speak, and are exceedingly cautious; but since the high lift pumps at Kladno have answered so satisfactorily I can scarcely satisfy the demands for designs of high speed and high pressure pumps in this mining district. I have lately designed two underground pumping engines for the Dannenbaum mine. Each of these engines is to lift 950 gallons 1650 feet high in one lift. One similar engine for Luise Tiefban, same capacity 1700 feet high. One underground engine for Hansa mine, 650 gallons 2100 feet high; and a few days ago I accepted to design for the same mine an underground engine to raise 1200 gallons 2400 feet in one lift."

Let the reader remember that this was in 1902, and since that time there has been marked improvement even in the celebrated Riedler pump.

On the Comstock lode the opportunities and advantages for operating great pumping plants are unsurpassed. The Sutro or Comstock tunnel extends from the town of Sutro and intersects the Comstock Lode 20,000 feet from Sutro on the 1650 foot level of the Savage mine. From the main tunnel there extends a north lateral drift into the Ophir ground. This north lateral drift is connected by mine workings of drifts and winzes with the joint Union Mexican and Sierra Nevada shaft still farther north, and through them and the shaft air can be conducted to the lower workings of the North End mines. Another branch tunnel extends from the main Sutro tunnel southerly to the Foreman shaft and the Alta shaft. From the main Sutro tunnel the north lateral extends 3325 feet and southerly extends 8700 feet to the shafts above mentioned. This great tunnel is large enough for a single track for mine cars, which were propelled by mules during the cutting of the tunnel. It can be readily seen that the present

resurrection of the Comstock mines rests on this tunnel. By it a new surface level is established 1650 feet underground, and to that new surface level the water lifted from the lower levels is drained to the mouth of the tunnel at Sutro, from whence it runs down to the Carson River. If necessary, ore could be taken out through this tunnel and worked at mills to be established at the mouth of the tunnel. It would not be difficult to install and maintain a narrow gauge electric railway in this tunnel for the transportation of ore, and perhaps in the future such a convenience will be established. To maintain this tunnel in the highest possible condition is a prime necessity to the successful prosecution of the important work now being done on the Comstock Lode. At this time this tunnel is exposed to a great danger in the shape of the moist heat and steam arising from the water now being sent through it. This steam and moist heat keeps the timbers saturated and rots them, and where the tunnel is in standing ground the steam causes it to slack and drop. The result is that men are constantly employed watching and cleaning the tunnel. These dangers could be avoided by enclosing the water so that the heat and steam would be confined. There is a drain already cut in the bottom of the tunnel, and to save this tunnel a 30-inch ironstone pipe should be placed in this drain. A pipe of this size would carry all the water now being sent through the tunnel, and if at any time it was found that the mines were making more water than a pipe of these dimensions could carry the application of a very little force would double its capacity. Every mine on the Comstock is interested in this proposition, and there should be immediate and unanimous action to install this pipe and save this magnificent tunnel. There are very few that appreciate what a grand engineering success this gigantic tunnel is. To-day we see no such work being undertaken on the Pacific Coast. The pioneers of the Comstock were truly masters, and we may well say of them that "there were giants in those days."

The value of the Comstock mines can scarcely be questioned. That all the bonanzas were deposited above the water level is not a tenable condition. The first requisite of a bonanza is a favorable formation in which to make it. The testimony of those who are the most familiar with the deep workings of the Comstock Lode prove conclusively that the formation is regular and that the conditions for finding ore are just as favorable in those deep workings as on the upper levels. The ledge is wide and well marked, and we have every reason to believe that good bodies of ore will be found on these lower levels. At the time that the Pumping Association was first formd the presidents of the various mines called on the superintendents to look over the old records and report to the Pumping Association the condition of the mines at the time of the shutdown of the pumps. We reproduce here the reports made at that time by the superintendents.

SIERRA NEVADA.

From the 2300 foot to the 2500 foot level there were 6077 14-2000 tons of ore extracted which yielded $195,213.53. The value of the gold in this bullion was $141,670.03. From the 2500 to the 3100 foot level there has been but little prospecting done. I consider there are good chances of finding good bodies of pay ore from the surface to the deepest workings of this mine in any of the unexplored ground. This has been demonstrated on the upper workings near old grounds, where large ore bodies have been found where least expected. I do not hesitate to say there will be many more discoveries of ore bodies, as we have a large amount of unexplored ground from the surface to the lowest level. The Sierra Nevada mine has over 6000 feet on the Comstock.

UNION CONSOLIDATED.

Between the years 1880 and 1883 43,311½ tons of ore were extracted from between the 2300 and 2900 foot levels of the Union Consolidated mine, of an average value of over $36 per ton, yielding $1,567,092.64, the assays ranging from $39.13 to $27.02 per ton. On the 2900 foot level a joint Sierra Nevada east crosscut was started from the joint Sierra Nevada winze and extended 287 feet. When in a distance of 130 feet from the winze the drift passed through a vein of ore 11 feet wide on the bottom of the drift and 6 feet wide on the top, the assays averaging $21 per ton. Work on this ore vein has since shown it to extend up 20 feet and south 63 feet in Union ground. A joint winze was afterward started 141 feet east of this ore body. The report does not show that this ore was ever found in its downward course. In sinking the above winze to the 3100 level narrow streaks of gold bearing ore were passed through, selected samples assaying high. The report does not show that any development work was done on these streaks. A study of the report discloses the fact that while depth was being attained by sinking winzes the levels above up to the 2300 level were not being prospected.

MEXICAN.

It appears from the report of D. B. Lyman, dated at Virginia City, Nevada, August 24, 1898, and compiled from the report of W. H. Patton, that no ore was found on the 2000, 2300 and 2500 foot levels. Ore was found in a drift south from the joint Union winze ranging from 12 inches to 3 feet, giving fair assays. This ore was followed a distance of 80 feet and sunk 60 feet, when water stopped the work. Ore was found in the winze at that depth.

It does not appear from the report that this ore body was found on the levels below. The work done from the 2900 to 3100 levels appears to have been done solely to secure ventilation. On the 2700 foot level of this mine the Comstock is said to be 800 feet wide, the vein matter being porphry, quartz and clay. The stratification from the east side from the 2700 level down to the 2900 foot level shows a dip approaching the vertical. On the 3100 foot level a main lateral drift was run to connect on through the Union Con. for ventilation. From this drift an east and west crosscut was started 300 feet from the south line of the mine. The east crosscut was run 28 feet and stopped by a strong flow of water. The west crosscut was run 24 feet and a diamond drill hole was run 12 feet farther, showing assays of from $2 to $6 per ton. This crosscut was dry. In 1884 no work was done in any of the levels above the 3100 foot level, except to maintain ventilation. From this level an east crosscut was extended 42 feet and a winze sunk therefrom 208 feet, reaching the greatest depth on the Comstock Lode (3308 feet). This winze passed through quartz of value at a depth of 134 feet below the 2100 foot level and porphyry and quartz; thence to the bottom. A station was opened on the 3300 foot level; a drift run 10 feet north; drill holes were driven north, west and east, showing no value. It appears from this report that ore bodies were found on the 2700, on the 2100 and in the deep winze at a point 134 feet below the 3100 level. The ore body on the 2700 level was partially prospected. That on the 3100 foot level was only touched by the diamond drill, and the ore body in the deep winze was not prospected. It further appears that while the work of attaining depth was in progress no prospecting in the levels above was done, the drifts being kept open for ventilation and drainage only.

CON. CALIFORNIA AND VIRGINIA.

The following deductions were made from the report of ex-Superintendent Lyman to the committee on the Comstock drainage and deep mining:

It appears from the report of D. B. Lyman, dated Virginia City, August 24, 1898, and compiled from the reports of W. H. Patton for the years from 1879 to 1884 and from Mr. Lyman's subsequent reports, that in 1879 ore was being extracted from the 1850 and 1950 levels. The ore was of fair grade and was taken from and around a winze sunk from the 1850 foot level in 1878 a vertical distance of 40 feet, and thence on the slope of the west clay to the 1950 foot level. During the years 1880 to 1885 no work was done on this level (1950). In 1886, deep mining having ceased, this level was reopened and some ore extracted, and this work continued through the next two years. Owing to the influx of water work was discontinued on this level on No-

vember 4, 1889. On the 1800 level in 1891 an east crosscut had been run 247 feet from the bottom of a winze 50 feet below the 1750 foot level. This drift passed through an 8-inch streak of ore that assayed $30 per ton at a point 186 feet in from the winze. The streak was followed for 17 feet, showing an increase of width, while maintaining its value of $30 per ton. This ore does not appear to have been further prospected. From the above drift a north lateral drift was started 85 feet east of the winze and run in a northerly direction a distance of 278 feet. From this drift two winzes were sunk, Nos. 1 and 2, and 45 feet from the bottom of No. 2 an east crosscut was run. At a point 26 feet east from the winze a south drift was run 68 feet, showing ore 8 feet wide and assaying $16 to $20 per ton, two-thirds of the value being gold. A great body of quartz exists on this level, long and wide. It has been prospected by lateral drifts and crosscuts and assays 50 cents to $3 per ton. The work of extracting ore from these various openings was continued until the time of the breaking out of the fire in December, 1892, when operations were suspended. During the years 1882, 1883 and 1884 work was carried on in the 2500, 2700 and 2900 foot levels. The work in the upper levels was confined to keeping ventilation drifts open.

The Con. California and Virginia joint winze was sunk to the 2900 foot level, and from this winze drifts were run on the 2500 and 2700 foot levels, all of which encountered a strong flow of water, and work was stopped. On the 2900 level, at the bottom of the C. & C. winzes, a drift was extended 300 feet to the east, from the end of which a drill was run farther, which tapped a body of hot water. Thereupon work was stopped.

It does not appear from this report that the ore bodies discovered by an east drift on the 1800 foot level, and assaying respectively $30 and $16 to $20 per ton, were worked or followed to their limits, and it does appear the ore was being extracted from various openings below the level of the Sutro tunnel, when the fire broke out in December, 1892, when operations were suspended. And further, that the attempted development work on the 2500, 2700 and 2900 foot levels was stopped by a strong flow of water.

It also appears from this report that on November 5, 1889, the water had risen to a point 125 feet on the slope below the 1950 level, where work was being carried on from a winze that had been sunk to that depth in an ore body that had been discovered on the 1950 foot level.

As work was discontinued on the lower levels in January, 1885, these figures indicate that the water filled the lower levels of the Comstock at the rate of 250 feet a year, counting from the 3300 foot level upwards. To the above the report will add that, referring to the lowest levels, ex-Superintendent Lyman's report

concludes with the following quotation from the report of the late W. H. Patton, formerly superintendent of the mine: "This work has demonstrated that the Comstock Lode in the lower levels continues to show great strength of formation, and the cutting of seams of quartz giving low assays in the various drifts on the 2500, 2700 and 2900 levels show that it is mineralized, with a possibility of finding ore deposits of value when the lower levels are fully opened."

THE SAVAGE MINE.

2200 Level.

Before the Sutro tunnel had been advanced to and connected with the Comstock workings a drift was run to the southwest from the 2200 level of the Savage incline and then turned to the northwest. When nearly under the incline a heavy flow of water was encountered, which flooded the levels of the Savage and Hale & Norcross mines up to a point about equal to the Sutro tunnel level, and was not reduced until after the Sutro tunnel connection, and not entirely so then, until what was known as the "Lightning drift" was run on this level from the Hale & Norcross and connected with the combination shaft, and through which a portion of the water was distributed.

When the water was struck a considerable quantity of quartz came out with the flow, but the flood was so sudden and so overpowering no chance was given to prospect it. The ground from which the water seemed to come has never been probed in any way since that time.

2400 Level.

A drift was run on this level from the combination shaft and connected with the bottom of the Savage incline, the latter being about 250 feet north of the south boundary of the mine. So far as I have been able to ascertain, no crosscutting was done from this drift in Savage ground.

2500 Level.

A similar lateral drift was run from the Hale & Norcross mine on this level and extended to the Savage south line, but it having encountered at that point a heavy flow of water it was stopped. No further work was done on this level in the Savage mine.

2600 Level.

A drift was driven on this level from the combination shaft to a point 60 feet in the Savage ground. A heavy flow of water was again encountered and the work was stopped and the drift bulkheaded. Seams of good ore existed in the face of the drift and for some distance back from the face.

2700 Level.

A drift from the Hale & Norcross winze was run to or very near to the Savage south line. Water was again encountered and

the drift was stopped. Small seams of ore were encountered in this drift also, both at the face and for some distance back from the face.

2800 Level.

A north drift was run from the Hale & Norcross winze on the 2800 level, but did not reach the Savage south line.

3000 and 3100 Levels.

North lateral drifts were started from the combination shaft, but on account of the heat, water and fear of more water no prospecting was done.

CONCLUSION.

From the 200 level to the 2600 level the Savage ground has not been prospected north of the main incline, and but very little from the incline to the south line. From the 2600 level to the 3100 level, inclusive, the ground is practically untouched and the work that was performed for the purpose of reaching our ground invariably developed water in large quantities and either seams and streaks of ore or ground that on the Comstock is regarded as favorable to the existence of ore.

CHOLLAR.

2400 Level.

This level was fairly well prospected, both by drifts and crosscuts, as well as by diamond drilling. Nothing of an encouraging nature was found.

2600 Level.

The lode was cut by means of a west drift at a point 420 feet west from the combination shaft, where it was shown to be 100 feet wide, with massive clay walls on either side. A drift was run north in the vein to the Hale & Norcross line. On its course it found nothing. Two hundred feet south of the line a crosscut was run west 200 feet, finding the vein strong and well defined, with a quantity of low grade quartz. Ten feet south of the north line a crosscut was run west. When in 50 feet it cut a stringer of ore 2 feet wide, and when in 70 feet another stringer of about the same size and character.

Assays from the ore streaks ran from practically nothing to $900 per ton. Small drifts were run north and south on the streaks, but found no improvement.

2800 Level.

On this level a northwest drift was run 180 feet from the combination shaft and connected with a drift from the Hale & Norcross winze.

From the point of connection a southwest drift was run a short distance and then turned directly south, the total length being 395 feet. Two crosscuts were run from it, 140 feet apart, cutting the vein in each, and finding 33 feet in width of clean quartz,

bounded by heavy and well defined clay walls. The vein was shown to have a course of south 20 degrees east and a pitch of 35 degrees east. A marked change for the better in the formation was found on this level over the corresponding portion of the ground above, and the quartz, while low in value, was of better grade than on the level above.

3000 Level.

A south drift was run 250 feet from the combination shaft, and a crosscut made from it, encountering low grade ore, but not sufficiently mineralized to warrant extraction.

3100 Level.

A south drift was run from the combination shaft to the Potosi line. It cut some fine looking quartz and struck also a strong flow of water, and bulkheads were put in both in this drift and on the 2800 level to restrain the flow.

3200 Level.

Short drifts were started north and south from the combination shaft, but about this time all work was suspended.

CONCLUSION.

The effort seems to have been to prospect the south end of the mine, where the formation was reported to have radically changed for the better. Except in one or two places, the work was hampered by heavy flows of hot water, of which all stood in dread, and in consequence a large part of the prospecting done was by means of the diamond drill. Emphasis seems to have been placed on the statement that the formation in the south end of the mine showed marked improvement. I can find no evidence of the prospecting of the north end of the mine under the ore seams exposed on the 2600 level, in the west crosscuts from the lateral drift. From the 1700 level, where a connection was made from the old Chollar incline with the combination shaft to the 2400 level, is a space of untouched and unprospected ground.

POTOSI.

2400 Level.

It seems to have been the rule in this level to skirt the east side of the lode, after running to it by means of a west drift from the combination shaft, and then diamond drill the vein. No direct evidence can be obtained from official reports as to the result, but judging from the statement made of the improvement in formation and value at greater depth, I presume nothing of any value was found.

2600 Level.

The south lateral drift on this level was run to a point 300 feet north of the Potosi south line. From its tracing on the map it is easy to see that it was run in constant fear of a heavy flow of water, as it is very crooked, and the way evidently felt as it

progressed. From the end of it a diamond drill hole was run 100 feet. A heavy flow of water was struck and the drift was finally bulkheaded to restrain it. No assays are recorded of it, but it is stated in the records that the value of the ground, as well as the regularity and strength of the formation, showed a marked change for the better over the levels above.

3100 Level.

A south drift was run 320 feet in Potosi ground. A crosscut was started, but quantities of water having been encountered, drill holes were run at various points, but finally, on account of the flow of water, work was stopped.

CONCLUSIONS.

The Potosi ground has been very little prospected from the 2600 level down; one might say it is practically virgin ground. The 2600 level was slighted—no doubt from the fear of water. It seems to have been the desire and aim of the management to reach a point in the mine under which it was stated the marked change in the formation, for the better, was disclosed. This desire was never consummated. Large blocks of ground remain unprospected from the 2400 level down, and from that level up are several hundred feet of entirely virgin ground.

CROWN POINT.

The lower levels of this mine were opened by means of a winze sunk from the south lateral drift on the 2000 level at a point 150 feet north of the south line. This winze was sunk to the 3000 level and connected with the Crown Point and Belcher joint pump shaft on the various levels opened, viz.: the 2300, 2500, 2700 and 3000 levels. To make corresponding levels in the joint incline it was necessary to sink 60 feet deeper; thus, for instance, the 2500 level of the Crown Point was equal to the 2560 level of the Belcher. The winze was sunk and the lateral drifts opened in the footwall to avoid water. It was the rule on nearly all the levels to run the crosscuts to the casing of the vein, and then to drill, for fear of flooding the mine. In places, however, notably on the 2300 level and on the 2700 level, a long east crosscut was run on each, without encountering any notable reservoir.

The preparatory work necessary to reach levels and the time occupied in sinking and making air connections was so great that the prospecting of these levels, so far as done, was spread over a long period of time. For instance, in order to cheapen the work and to find means to hold any large amount of water that might be struck, a long drift was run, occupying many months, from the Crown Point winze to the new Yellow Jacket shaft, on the 2700 level. After it was completed and prospecting actively commenced, some time during the year 1880, the pumping engine at the new Yellow Jacsket shaft was almost entirely destroyed through

an accident to the flywheels. The water rose to the 2160 level tank in the Belcher and Crown Point pump shaft, in spite of the greatest efforts on the part of the joint pump. After the Jacket pump engine was repaired the water was slowly and gradually lowered to the 2760 level again, the inclines, winzes, drifts and connections cleaned out and repaired at a large expense, and after a long lapse of time, when the reservoir of water was struck in the Exchequer, the mine was flooded again from that flow, just when prospecting was to begin again. Since that time the mine has remained flooded.

CONCLUSIONS.

On the 2000 and 2300 levels large quantities of quartz were uncovered, which is believed to be of the same character as that subsequently extracted from the levels above—"gold ore." At that time assays of $8 to $10 per ton attracted no attention. It can not be determined at this time whether or not the grade of this quartz would warrant its mining and milling, but with the cheaper means of milling now in use it is deemed that it is quite possible that such would be the case.

From the accidents that occurred, the lower levels were never thoroughly explored, but the formation continued at the greatest depth strong and solid and with as perfect definition as anywhere in the mine. Should the prospect that was found in the Belcher on the 2760 level prove to be of value, I would look for similar development in our ground, for the two mines have apparently occupied jointly the same mineral bearing zone in the past, and have exposed on other levels, both in the bonanza and higher levels, analogous chimneys of pay ore, having in all respects identical characteristics.

BELCHER.

Superintendent Smith, in his annual report of 1880, in speaking of the 2760 level says: "The ore streak found on this level, 300 feet south of the incline shaft and 120 feet east of the main south lateral drift, a south drift was run a distance of 160 feet, passing through a mixture of quartz and porphyry, which yielded some very good assays. From the south end of this drift a crosscut was run in a distance of 50 feet through porphyry and streaks of quartz. From the end of this crosscut a diamond drill was driven in east a distance of 96 feet, passing through porphyry and quartz, yielding low assays." A strong flow of water compelled them to stop.

A north drift was run on the ore a distance of 86 feet, passing through bunches of good ore. A winze was sunk on the vein to a depth of 75 feet, passing through porphyry and quartz. A strong flow of water compelled them to cease work at this point. No further work was done on this level south of the incline shaft.

North of the incline shaft a lateral drift was run to the north line, and one east crosscut was started 20 feet south of the line and continued a distance of 100 feet. This north lateral drift connected with the new Yellow Jacket shaft, but no prospecting work was ever done from it.

It is evident from the foregoing facts that the Belcher mine from the 1650 foot level to the 3000 foot level has not been prospected in a thorough manner, and from the very favorable showing on the 2760 level it would seem that with more thorough prospecting it is not unreasonable to suppose a large and valuable ore body might be encountered. The present condition of all the levels now under water can only be surmised. My opinion is that, owing to the many favorable prospects at different points on the Comstock on the lower levels and now under water, the mines should be drained and work resumed at these points.

SEG. BELCHER AND MIDES.

Report of the superintendent of the Seg. Belcher and Mides Consolidated Mining Company to the committee on pumping:

From the 1650 foot level to the 1900 foot level no work has been done.

On the 1900 foot level a lateral drift was run from the same level of Belcher corresponding with this level to the south line of the mine. From the lateral drift near the center of the claim an east crosscut was run a distance of 100 feet. From the end of this crosscut a winze was sunk to the 2360 foot level; no further work was done on this level.

From the Overman 1900 foot level, which corresponds with the 2160 foot level of Seg. Belcher, a north lateral drift was run to the north line of the mine. From this drift on the south line a crosscut was run to the east a distance of 300 feet and one west at the same point a distance of 100 feet. No further work was done on this level so far as the maps show.

On the 2360 foot level a crosscut was run on the north line a distance of 200 feet to the east passing through the footwall of the vein and stopped. No further work was done on this level, and from this point down no work of any importance has ever been done.

OVERMAN.

All quartz found below the Sutro tunnel level in the Overman mine was of low assay value. For 400 or 500 feet down from the

tunnel level the ground was well prospected, excepting south of the shaft. In the lowest workings the prospecting was not complete and much unprospected country lies south of the shaft below the tunnel level.

JUSTICE.

Superintendent Belknap, of the Justice Mining Company, says:

"While we are not troubled with water, as we are not working at a depth sufficient to be affected by it, yet from the present developments in our upper levels we intend in future to sink and prospect deeper, as indications undoubtedly point to a downward continuation of the ore developed in our present workings, and as the draining of the Comstock is of vital importance to all mines on the Lode, I recommend that the company join the Pumping Association."

Our examination of the different levels of the Woodville shaft show a large quantity of fair grade ore which could be easily extracted. The old stopes on the 370 and 490 foot levels contain a great deal of ore, which in early days was passed as low grade, but which would now be classed as milling ore, and the same may be said of the 800 foot level, where a large quantity of this class of ore is in sight.

ALTA.

The following extract is from the report of Superintendent Boyle, of the Alta Silver Mining Company, to the committee on pumping and deep mining:

Gentlemen—Ground was broken and the work of sinking the Alta shaft commenced in September, 1875. Work was pushed rapidly.

In July, 1877, our first crosscut was started at a depth of 1050 feet and run west a distance of 238 feet, where a body of fine ore was discovered, on account of which the stock advanced from a few cents to $29.50 per share. Then the work of sinking was vigorously resumed and continued to the 1150 level, where a station was opened, a drift run to the vein and some ore extracted, with but little exploratory work done. The 1250 level was next opened and a drift run north on a vein a distance of 700 feet. Little work was done to the south of the shaft. Some ore was found on this level of a low grade, but which could be profitably worked now.

The shaft cut the vein between 1260 and 1300 feet, where ore of apparently milling value was found, but in our haste to get

down no samples were taken for assay. The 1350 station was cut on the east side of the shaft, a crosscut made through the vein, and the little work done on this level uncovered some bunches of very rich ore, mostly gold. The east crosscut here shows a body of quartz liberally mineralized. I consider this a very important level.

Our second pump station below the Sutro tunnel level is located at this point.

The 1450 level was opened, a crosscut run east to the hanging wall and a drift run north on the vein a distance of about 600 feet. Promising indications were found all along this drift, and, although it did not show rich anywhere, the grade of the ore was uniformly from $10 to $15 per ton.

A sample lot of this ore, milled, yielded from $12 to $14 per ton.

The 1550 level was next opened and a drift run in the vein to the north line of the Lady Washington ground, a distance of 1769 feet. The greater portion of this drift was through barren ground, but as the vein was only partly explored I have an idea that ore will be found in considerable quantity, after a thorough system of crosscutting.

Ore of variable grades was found in about 400 feet of Alta; and in Lady Washington these crosscuts disclosed very good prospects for ore in paying quantities.

At a point in this drift 440 feet north of the shaft a station was excavated from which a three-compartment incline winze was started and continued down to the 2050 level, vertical depth. Stations were opened first at the 1750 level and drifts run north and south a distance of about 400 feet.

The south drift on this level was not extended beyond 90 or 100 feet. Next was the 1850, which, like the other levels, was not exhaustively prospected, but good indications were found everywhere; then the 1950 was opened and a drift driven to the south line a distance of 700 feet. In this drift, near the center of Alta ground, we ran into a body of galena ore which assayed 70 per cent lead, 6 ounces silver and $10 gold per ton. The drift continued in this ore about 80 feet, and a crosscut at this point showed a width of 24 feet of good concentrating ore. In my annual report for 1880 I stated the average value of this 24 feet, and my impression is it was about $30 per ton gold and silver and about 15 or 20 per cent lead.

Little importance was attached to this at that time, as we were not then mining for the "baser metals," but with our present facilities for concentration it would furnish a valuable product for smelting.

We next opened the 2050 level, where a considerable amount of work was done, but, finding more water than we could handle with our donkey pumps, the diamond drill was extensively used in exploring the vein, and for prudential reasons four holes were

bored in the vein, two of which gave indications of value and a flow of water that submerged our pumps, so we were obliged to abandon the winze and concluded to forthwith sink the main shaft from the 1550 to 2150 level, 100 feet below the bottom of the winze, which was done accordingly.

On the 2150 level we sent out an east drift a distance of 1230 feet, and employed the diamond drill a farther distance of about 200 feet. Streaks of ore 6 to 8 inches wide were cut, which assayed from $75 to $142 per ton.

A peculiar formation was encountered in sinking the main shaft. At the depth of 2080 feet we struck the apex of a ledge running north and south and widening so rapidly that it had the appearance of pitching two ways. It continued in the shaft to the bottom, where, on opening east and west, it was found to have a width of nearly 200 feet, pitching east on the east side and west on the west side, with a strong capping of black dyke on each. It is a calcite vein, strongly impregnated with chalcopyrite, and will assay from $1 to $4 per ton, gold and silver.

The condition of the shaft is good, excepting possibly about 80 or 90 feet near the 1800 pump station. The ground at that point was of a clayey nature, necessitating occasional easing, but it never gave much trouble in that respect. When the lower levels were abandoned in December, 1884, the flow of water in the mines was 630 gallons a minute.

CALEDONIA.

The above reports were written in 1898. Since that time the Caledonia mine has been extensively prospected from the 900 foot level to the 200 foot level, and the indications are certainly more than favorable for the making of a big mine on the lower levels. We are not in possession of a detailed statement from the superintendent, but we know from personal conversations with him that he is very sanguine of the future of the mine.

Others who have been in the workings of this property also speak very highly of the future of this mine.

EXCHEQUER, BULLION AND ALPHA.

There are certain fixed natural laws in force in the Comstock Lode, and those laws govern the formation of ore kernels or bonanzas in the ledge matter lying within the walls of the ledge. These natural laws point almost absolutely to a deposit of ore in the lower levels of the Exchequer mine, between the 2600 and 2900 levels. As it has been demonstrated that the ore found in the lower levels of the Comstock carry a larger percentage of gold than that found on the upper levels, the ore body in the

Exchequer mine would carry a large percentage of yellow metal.

In addition to the natural indications, the Exchequer mine is in the neighborhood of a mine that produced an immense amount of gold ore and bars of bullion that showed values in each bar of from $25,000 to $28,000. We have no report from superintendents on this mine, but we know the opinion of those who are practically familiar with this ground, and we know that it coincides with our theoretical one. It will take time to demonstrate these opinions, but we were never more positive of anything than we are of the existence of an ore body in the lower levels of the Exchequer mine. We believe that it will extend into the Alpha on the south.

North of the Exchequer and adjoining that mine the Bullion mine has 1000 feet of ground. It has been demonstrated that in this ground there is an immense body of quartz, which is comparatively unprospected. The possibility of finding ore in paying quantities in this mine is great, as the surroundings and conditions are favorable. The ledge is well defined and very wide, and no one can prophesy as to what it contains.

The connection recently made between the Ward shaft and the south lateral drift of the Sutro tunnel is a most important one. By means of this opening a free circulation of air is possible through the Alpha shaft on the south and the combination shaft to the north. The Ward shaft is a "downcast" shaft, while the Alta shaft and the combination shaft are "upcast." This makes the circulation. With plenty of air numerous openings can be driven into all the mines from Gould and Curry on the north to Alpha and Exchequer on the south, and perhaps farther south than that. Nothing could be more important to the Lode at this time than this connection, and we believe it will lead to better conditions on the Lode and on the street.

The Comstock Lode has produced in the neighborhood of $500,000,000, and the bulk of this great sum has been from the workings above the tunnel level. We firmly believe that the lower levels now under water will prove just as fertile as those above water, and we believe that the present efforts to unwater and open the lower levels will surely be successful and will lead to the discovery of high grade bodies of ore. The unwatering of the lower levels of the Con. California and Virginia and Ophir have demonstrated the existence of pay ore below the water, and there is no reason to believe that these two mines are the only ones that can repeat the richness found on their upper levels.

The following is self-explanatory:

VIRGINIA, Nev., Sept. 12, 1898.

Charles H. Fish, Esq., President General Committee on Comstock Drainage and Deep Mining, San Francisco, Cal.

Dear Sir: In response to the request of your committee for

information concerning the levels of the Comstock mines below the Sutro tunnel, we respectfully submit the accompanying reports, which are summarized from the weekly and annual reports of the superintendents who had charge of the mines prior to 1886, before deep mining was suspended, which said reports detail the exploratory work done in the levels below the Sutro tunnel in the several mines, to wit: Utah, Sierra Nevada, Union, Mexican, Ophir, Cons. California and Virginia, Gould & &Curry, Savage, Hale & Norcross, Chollar, Potosi, Yellow Jacket, Kentuck, Crown Point, Belcher, Overman, Caledonia, Alta, Justice.

The reports show that in several of the mines mentioned pay ore was found below the level of the Sutro tunnel at points ranging from the 1800 to the 3300 foot level, which was the deepest point reached. The opening and partial prospecting of the lower levels was done in constant fear of encountering water in excess of the pumping capacity. The history of the Yellow Jacket deep workings shows this fear to have been well founded. The great width of the Comstock Lode calls for an enormous amount of development work in each level before the ground can be said to have been thoroughly prospected. In illustration of this fact we call attention to the great yield of ore from Crown Point, Belcher, Yellow Jacket, Chollar, Hale and Norcross and Cons. California and Virginia mines (bonanzas), after they were supposed to have been worked out.

In the light of such developments as were made in the vicinity of these bonanzas and of the discoveries at and near the surface recently made in the North End mines, it can be truly said that there is not a level on the Comstock Lode that has been so thoroughly prospected that there is not yet a chance of finding ore in it.

Becker, in his "Geology of the Comstock Lode," says: "The first condition for the formation of a quartz body is an opening to receive it. The group of mines worked through the Union shaft and the Yellow Jacket, Crown Point and Belcher mines show peculiarities of structure which point to the likelihood of such openings in lower levels. Openings such as that which contain the Cons. Virginia and California bonanzas, however, gave almost no warning of their approach from above and may at any time be struck in the intermediate mines."

With modern pumping appliances placed along the Lode so as to pump the greatest quantity of water at the least possible cost, we feel safe in saying that all the water that was encountered in the lower levels can be handled for very much less than the former cost, and at the same time providing for pumping much larger quantities of water than was found in all the deeper workings. Such machinery would enable a thorough exploration of all the lower and still deeper levels to be made in safety, while the old system only allowed a partial prospecting and in some cases the levels were barely opened when the works were suspended.

In conclusion, we wish to state that in consideration of the fact that it has been figured that a modern pumping plant can be operated on the lowest level of the Comstock Lode and pump the water to the Sutro tunnel for one-twelfth of the cost of pumping by the old system, and assuming that such calculations can be verified and then considering the favorable prospects that were encountered together with the great area of unexplored ground on the lower level, we do not hesitate to advise the expenditure of the money necessary to install and operate a complete modern pumping plant for the drainage of the lower levels of the Comstock Lode.

D. B. Lyman, ex-Superintendent Ophir, Mexican, Union, Utah and Con. California and Virginia.

G. McM. Ross, Superintendent Con. California and Virginia, Ophir and Mexican.

P. Kervin, Superintendent Gould & Curry.

H. M. Gorham, Superintendent Savage, Chollar, Potosi and Crown Point.

Jos. R. Ryan, Superintendent Hale & Norcross and Andes.

W. E. Sharon, Superintendent Yellow Jacket, Belcher, Seg. Belcher, et al.

A. Lackey, Superintendent Overman and Caledonia.

E. D. Boyle, Superintendent Alta and Lady Washington.

James H. Kinkead, Superintendent Occidental and Kentuck.

Clayton Belknap, Acting Superintendent Justice.
A. C. Hamilton, Superintendent Alpha and Exchequer.

R. Prendergast, Superintendent of Bullion.

J. H. TINGMAN.

October 15, 1904